BLM LIBRARY
88045957

RESEARCH NEEDS AND PRIORITIES FOR BLM FORESTRY IN WESTERN OREGON

By

John F. Dwyer

William A. Duerr

PROPERTY OF
Bureau of Land Management
DSC LIBRARY

REPORT 11

GUIDES TO LAND MANAGEMENT PROJECT

U. S. Department of the Interior

Bureau of Land Management

Portland, Oregon, June 1971

Draft

SD
144
.07
D994
1971

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER CO 80225

ID 88045957

SD
144
.07
D994
1971

RESEARCH NEEDS AND PRIORITIES FOR BLM FORESTRY IN WESTERN OREGON

By

John F. Dwyer

William A. Duerr

REPORT 11

GUIDES TO LAND MANAGEMENT PROJECT

U. S. Department of the Interior

Bureau of Land Management

Portland, Oregon, June 1971

Draft

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

CONTENTS

	Page
Introduction and Background	
Explanation of the Report	1
Judging Research Priorities	4
Land Use	6
Uses of the Forest	8
Forestry for Multiple Products	
Integrated Forestry	12
Transportation	15
Forest Protection	19
Intensive Timber Management	
Forest Regeneration	24
Tree Improvement	28
Tree Spacing and Stand Thinning	33
Forest Type Conversion	37
Site Improvement	38
Timber Harvesting	41
Allowable Cut of Timber	46
Timber Marketing	48
Systems View of Management	
Forestry as a System	52
BLM's Role in the Economy	53
An Information System	56
Continued Problem Analysis	57
Appendix: Research Questions by Priority Class	58

(The start of each section after the first is marked thus: * * * *)

RESEARCH NEEDS AND PRIORITIES FOR BLM FORESTRY IN WESTERN OREGON

By

John F. Dwyer and William A. Duerr

The reader who wants just the gist of this report should confine himself to the passages in italics.

The report as a whole (1) identifies research questions and gives them priorities, (2) offers, as background, predictions about western Oregon forestry of interest on their own merits.

This report gives the highlights of a problem analysis for Bureau of Land Management forestry in western Oregon. The analysis is a part of the Bureau's research project, Guides to Land Management, and was developed principally from three types of sources: (1) other output of the Guides project, (2) the published literature, and (3) interviews with knowledgeable persons in BLM and outside.

Although the thinking of many persons is here reflected, this is not a report on the consensus: It is a statement of the writers' ideas and conclusions.

The problem analysis follows a three-step approach.

First, with an eye to the current situation and the trends, the report predicts the circumstances surrounding forestry in western Oregon. Predictions stress the near future, but run to a 2020 horizon. Orientation to the future is essential in a study of research: The pertinent issues are those that will be live when the research is finished and the results have borne fruit, which in forestry may take a long while. Many of the forecasts are stated categorically--not because there is no uncertainty in the writers' minds, but because the omission of qualifiers makes for valuable brevity.

Second, the report envisages the forestry research which will help answer the questions of the future. Research, here, means creating information to serve as a basis for decisions. It means developing new facts, interpretations, and procedures. It may mean the insight into a problem which comes to the manager in the ordinary course of his woods or desk work. Or it may mean the output of ambitious studies undertaken for the Bureau by the research contingent of another public agency or an academic institution.

Third, the report sets priorities upon the recommended research. In this, and, indeed, throughout the report, the viewpoint is that of BLM: The research questions identified and the priorities given them are designed to help the Bureau meet its goals effectively. Here the writers assume that Bureau goals are generally expressible

in public-interest terms such as these: Adherence to the law. Revision of the law to accommodate changing circumstances. Increase in personal real income and material well-being. Equitable distribution of income. Efficient use of resources. Production of goods and services in accordance with the principles of comparative social advantage. Optimum rather than maximum output of goods and services, including those of the forest. A use, over time, of forest raw materials, finished goods, and services which will contribute most to the well-being of consumers in general and not necessarily of specific landowners, producers, branches of industry, or communities.

The result of the foregoing three steps is intended to be both a plan for the consideration of administrators and research workers and a forward glimpse of western Oregon forestry which will be useful to Bureau managers.

Timber growing and sales are the primary subject of the report, though occasionally the discussion extends to timber harvesting, manufacture, distribution, and use. Services of the forest such as recreation, wildlife, and watershed benefits are brought into the analysis to the extent that they influence timber production. This is not to imply that timber does or should occupy the dominant position in BLM forestry: It is merely to adhere to the scope set for this study when it was planned.

The unit of research recognized in the study is the question, conceived as an appropriate package of work for a team or individual.

The scope of each question is meant to be broad enough to include matters bearing directly upon the issue at hand, but narrow enough for the research to be manageable.

* * * *

Research priorities are judged on the basis of five criteria: significance, immediacy, promise, economy, and neglect.

Each research question is assigned a priority score (0 to 100) on the basis of five criteria, as follows: First, significance (S): Bearing upon the achievement of BLM goals. How much difference will it make if the research question is answered? Second, immediacy (I): Desirability and opportunity for proceeding at once with the research. Is it an urgent question? Can it be studied without first studying underlying questions? Third, promise (P): Probability of bringing the research to a successful conclusion, with usable results. Is it comparatively low-risk research? Fourth, economy (E): Prospective ease of accomplishment, financially speaking. Is this comparatively low-cost research? Fifth, neglect (N): Failure of others to study the question. Has no one else been working on it or provided answers? The total score for a research question is derived by

rating the question on a 0 to 20 scale according to each of the five criteria and then adding the ratings.

Each research question is assigned, also, a priority class (top, high, medium, low) based upon the total score plus some further considerations. Among the latter are the existing research commitments of the Bureau and the availability of research talent. In most cases, such considerations are accorded relatively little weight, and consequently the correlation between priority score and priority class is very close.

The priority score and priority class arrived at for each research question represent the judgment of the writers. We were, of course, influenced by the judgments of the many persons with whom we exchanged opinions, but, as with the report as a whole, the result represents, not a consensus, but a statement of our ideas and conclusions.

For each of its subjects, the report takes a look ahead and then names the research questions which are seen to be relevant. These questions are in some cases explained--or even elaborated with a discussion of promising study methods. But in no case is a plan laid out. Planning is considered to be a step separate from problem analysis, a step to be taken for proposed studies which are of sufficient interest. On the basis of such planning, the final decision can be made about the choice and scheduling of studies.

* * * *

Looking, now, at the decades ahead, we foresee that BLM's central and all-pervasive forestry issue will be multiple use ("integrated use," we'll call it) of the Bureau's forest lands.

This is so because integrated use will become the watchword for forestry generally--and for BLM more than for other forest managers.

Take the case of land acreage. The area of all forests in western Oregon will diminish; BLM forests will shrink at a slower rate and thereby become more significant.

There will be a net movement of land out of forest into urban uses: commercial, industrial, and residential. The rate of loss will be dampened by increased efficiency in the utilization of urban land: a greater stress upon multi-family dwellings and high-rise buildings and a trend toward round-the-clock use of commercial buildings, churches, and schools. Some of the most productive timberland will be lost, and BLM's loss will be at somewhat less than the average rate.

The great era of roads and wheel-borne vehicles which is now reaching its apex in the United States will largely run its course

within the half century contemplated in this analysis. Nevertheless, in the years just ahead, roads and road building will still be exerting impacts upon land use. In western Oregon, highway construction will have little influence upon forest acreage. But the building of forest roads will be significant: Such roads will consume 315,000 forest acres (60,000 acres BLM) in western Oregon in the next couple of decades. After that, the trend toward forest-road abandonment and reversion will gather momentum.

Other subtractions of forest land, such as for pipeline and powerline rights-of-way and water developments, will be significant but small. Acreage occupied by rights-of-way will increase at a decreasing rate as higher-capacity transmission lines are put into use, thermal power sources are developed close to consumers, and several types of transmission are routed through the same corridors. BLM loss will be at about the average rate. The requirement for new water developments will be reduced by increasing re-use of water and increased desalinization as well as by thermal power installations. Water developments will not only supplant forest land, but also entail landscape management and the reservation of scenic corridors for the benefit of recreationists attracted thereto.

A countervailing force will be the shift of small acreages of land from farm into forest use. Pastures will shift over as it becomes more efficient to raise livestock on intensively managed feedlots and as the pollution problems currently associated with feedlots

are solved. Livestock grazing of forested areas and attendant damage by livestock will become insignificant. Agricultural technology for both livestock and crops will continue to increase production per acre and thus permit an expanding population to be fed from a nearly static farmland base.

On the whole, the most significant decrease in forest acreage will be in private ownership, particularly the smaller holdings near growing population centers. Forest area administered by BLM will decrease at a slower rate than private forest-land acreage, but at a rate somewhat faster than for the national forests.

* * * *

The strategic importance of BLM as a source of timber will increase.

Forest lands of timber-production quality reserved for non-timber use now total 280,000 acres in western Oregon. Additional lands of about the same acreage will be set aside from the timber column in the decades just ahead. These will be public lands, but BLM, because of location, blockage, and other characteristics, will contribute far less than its proportional share to the reservation

program and thus will find its relative position as a timber producer enhanced.

Concurrently with forest preservation, two influences opposed to it will be gaining force. One will be an increasing public acceptance of integrated forestry as people observe it on demonstration areas and in operation. The other will be the simulation of forest-related aesthetic and recreational experiences--in the home, on the residential grounds, and at other points within the urban setting. Simulation's immediate impact will be the opposite of its impact in the longer term: Immediately, it will reinforce the preservation movement, just as the televising of sporting events temporarily reinforced attendance at such events. But in the longer term, simulation will substitute for actual experience and thus relieve the pressure for preservation.

Besides preservation, other forces which will enhance the Bureau's relative position as a timber producer will be these: More and more private, nonindustry forests will be reserved from timber cutting as owners' material prosperity increases. Improvements in timber-production technology will underscore the comparative advantages of timber-growing on the more accessible and higher-site lands such as those administered by the Bureau of Land Management.

BLM will be a key producer of outdoor-recreation and aesthetic values, fish, wildlife, and other nontimber forest benefits.

The general public will make much direct use of BLM lands in the years ahead. Such use will be favored by the accessibility of these lands (compared with other public lands) to urban centers. Further, the scattering of Bureau land tends to enlarge the public's contact with it.

The Bureau will convert its forests to young growth faster than will the Forest Service and can appeal to recreationists on the strength of young-forest uses, notably for wildlife propagation and for hunting and campgrounds. An example of a highly successful recreational development in a young forest is the BLM picnic area at Wildwood, Oregon. The Bureau will find the means for maintaining its young forests through prompt regeneration of cut-over lands.

Some forest-land exchanges will take place between BLM and other forest holders, but the general location of lands administered by BLM will not be altered significantly.

In some parts of western Oregon, BLM lands will become intermingled with private residential and recreational developments. In these areas, the Bureau will place increasing emphasis on landscape management and the production of nontimber values.

The foregoing trends, taken with the varied habitat represented by BLM lands, will make the Bureau a leading producer of fish and wildlife. The Bureau will be managing a large part of the western Oregon fisheries habitat and big game winter range and a significant

part of the summer range and eagle nesting areas. Thus BLM lands will be widely used for hunting, fishing, and the observation of wildlife and contribute to the opportunities for these activities in other areas.

The Bureau's timber production and road development will carry with it the necessity for giving close attention to water quality. BLM's long perimeter and the location of its lands at elevations generally higher than private lands will require it to be sensitive to water management in the interest of its neighbors.

Prospects are for heavy demand for all forest outputs.

Strong demand for all the many products of the forest will flow from their long-term usefulness and from steeply rising population and income.

Western Oregon's culture embodies freehanded use of all the forest resources. The region's layout, a north-south band of concentrated population closely flanked by abundant forests, has fostered this cultural trait and will perpetuate it. High consumption today means high demand tomorrow.

From outside western Oregon, too, will come persistent demands for the region's forest goods and services. Californians, particularly, will augment the market for recreational services, and the region will export wood widely within the U. S. and around the Pacific.

* * * *

Consequently, it is essential that the Bureau of Land Management develop technology and guidelines for on-the-ground application of integrated forestry. Three research questions call for answers.

Question 1.

S 20 I 20 P 17 E 15 N 18 Score 90 Top priority

How can BLM establish rapport with the public concerning its land-management procedures: teach the public to appreciate management problems and methods, and also listen to public reactions and suggestions and benefit from them?

How may existing and newly proposed integrated-forestry techniques be tested and developed effectively? How, especially, may wood and scenery-recreation be developed as compatible enterprises?

A pilot-tract approach may be effective for this research. Pilot tracts may be useful in focusing public attention on specific tests.

Such research will require fairly sizeable pilot areas, perhaps one in each district at the start. Each tract will incorporate

recreational facilities, self-guided tours, and possibly a headquarters for information, with exhibits and the like to explain the project. The tracts will demonstrate on the ground what can be accomplished under an integrated-forestry regime and will help resolve conflicts between forest managers and conservation groups over the impact of timber production upon nontimber forest benefits.

Question 2.

S 20 I 20 P 15 E 12 N 15 Score 82 High priority

What are the workable methods for producing the various forest values together on the same forest tract, and what are their results?

This is basic research into the technology of integrated forestry. It is designed to develop, test, and explore new methods and to discover the consequences of these methods in terms of the output of forest goods and services over time. The effort will be made to work out the silviculture and engineering of wood-water-wildlife-recreation forestry on each of BLM's principal classes of forest land in western Oregon.

Research on Question 2 clearly bears a close relationship to that on Question 1. Promising inspirations developed on the pilot tracts can be studied and enlarged in the Question-2 research, and the latter will produce a flow of ideas for pilot testing.

Question 3.

S 19 I 17 P 14 E 16 N 18 Score 84 High priority

What guides can be used by the Bureau of Land Management in making integrated-forestry decisions?

That is to say, how may the Bureau decide which of the alternatives identified in Question-2 research is acceptable under given circumstances? Or again, how may the Bureau decide how to allocate funds and manpower among alternative lines of forestry production such as recreational developments, fish management, and timber culture? It is in this research that BLM faces the question, not merely what can be done, but beyond this, what shall be done. In other words, the technological alternatives are weighed on the Bureau's value scale.

The research should not be directed at setting dollar values on units of output. Rather, the studies should be aimed toward a system for using the most successful decisions of the past as a tentative guide to future action.

In this and subsequent discussion, "value" is meant as the degree to which the technique in question meets BLM goals--e.g., attainment of a large flow of goods and services from the forest, while holding down or eliminating the damages or other negative results which BLM desires to avoid. (see pages 2-3) Part of these considerations

may, in some instances, be appropriately expressed in financial terms, though nonfinancial terms will be more commonly used. In any case, value will be considered for the system, not for some isolated element thereof. It will be desirable to set up alternative criteria of value for choice by the decision maker.

* * * *

Two large collateral issues of integrated forestry are transportation and protection.

Transportation technology bears widely upon all aspects of resource management. The impending revolution in transportation, which will take us out of the era of roads and wheeled vehicles and into the air era, will have a large impact on BLM.

The impending revolution suggests two general areas of research, one dealing with its effects on the total resource-management program, the other concerning the roading program during the transition in transportation technology.

Changes in transportation will overthrow traditional concepts of accessibility, wilderness, forest recreation, integrated forest management, and other aspects of the BLM forestry system.

Question 4.

S 20 I 14 P 17 E 12 N 20 Score 83 High priority

How can BLM prepare itself for the revolution in resource management that will attend the passing of the road era? What will be the issues of the transition?

What are the prospective changes in the transportation of materials and personnel? What of the helicopter, various hovercraft, jet-powered back pack, and other methods of transportation? How will the changes affect our traditional concepts of legal and physical access, timber harvesting, wilderness, forest recreation, integrated forestry, and other elements of management which have been closely tied to the presence or absence of roads and motorized, wheeled vehicles? How will increased aerial transportation affect aesthetic values?

Developments in transportation technology will most likely originate in urbanized areas and then be adapted for forest use. A feature of the research will be talks with experts in the field of transportation who have opinions on future developments.

Although the era of roads and wheel-propelled vehicles is now reaching its apex in the United States, still there are questions about roads which will be of concern to the Bureau for some years to come. Four research questions call for answers.

Question 5.

S 16 I 18 P 4 E 6 N 15 Score 59 Low priority

What is the ideal system of roads?

This research concerns planning the road system: its mileage, location, and the schedule of construction, maintenance, improvement and abandonment--all in light of the standards to which individual roads will be built and the use which will be made of the roads. This question is closely related to Questions 6, 7, and 8, which consider specific aspects of the road system. These subsequent questions ask for information valuable for planning the road system, and at the same time they must be studied in the context of the total road plan for BLM and adjacent and intermingled landholders.

Road development is an influential part of the BLM forestry system as a whole and is intimately tied to all other segments of this system. Thus meaningful analysis of roading questions requires a systems approach and most likely the use of computerized simulation techniques.

Question 6.

S 12 I 20 P 13 E 12 N 12 Score 69 Medium priority

What rules can be set up for road bed, surface, width, and other characteristics?

This question is concerned with road design, or setting the standards of construction. It represents one aspect of planning the road system (Question 5) and must be studied in light of the entire system, particularly road location and expected use.

Question 7.

S 11 I 18 P 13 E 15 N 15 Score 72 Medium priority

With a given construction budget, which roads are best chosen for activation?

Development of roading priorities is the aim of this research. The same question may be asked concerning allocation of the maintenance budget. Both questions are to be studied in light of the entire road plan, particularly prospective road use and cost.

Question 8.

S 8 I 7 P 14 E 14 N 20 Score 63 Low priority

What are the prospects, timing, and priorities for road abandonment?

What is the technology of road abandonment and reconversion to other use, and what is the bearing of such technology upon today's road standards and planning? Work on this question will draw heavily on research into Question 4. The study should consider alternative uses for roads, such as firebreaks, openings for wildlife, foot and vehicle trails, recreation areas, and so on.

* * * *

Along with questions about roads, those about the control of fire and pests have wide significance to all aspects of BLM forestry. Forest-protection measures will be intensified as management for all the forest values is made more intensive, as the threat of loss becomes more serious, and as the general public becomes more concerned about losses and their control.

Gaps in our knowledge of insects, diseases, and other pests call for mending through research. We need to understand more about pests' behavior as a basis for measures of control and about their impacts upon the BLM forestry system as a basis for judgments about the methods and intensity of control. Our knowledge is particularly deficient in respect to interactions between pests and other parts of the forest ecosystem. The deficiencies are in many cases widening as we continue to alter the ecosystem.

The shift to young-growth management and the intensification of silviculture will call for emphasizing (1) prevention of losses rather than suppression, (2) control of defoliators rather than bark beetles, (3) attack upon root rots rather than stem diseases, (4) control of animal damage in young stands.

BLM interest in forest-protection research is somewhat dampened by the fact that the Bureau has little direct supervision over programs of protection for its own lands in western Oregon. Furthermore, both the Forest Service and the forestry schools are active in this research area. Nevertheless, the Bureau has a positive interest in the protection problems represented in Questions 9, 10, and 11; and of course it is immediately concerned in Questions 12 and 13:

Question 9.

S 16 I 20 P 17 E 10 N 5 Score 68 Low priority

What are the prospects for dealing with logging slash by some combination of (a) more intensive utilization and (b) destruction of unused material by means other than burning?

How feasible will alternative methods be? What impact will they have on environmental quality, reforestation success, timber-sales procedures, and losses to all destructive agents?

Emphasis on fire prevention rather than suppression will require improved techniques for predicting fire danger. Such techniques will be a helpful guide for stopping high-risk logging operations at critical times and for taking action to prevent the creation of dangerous forest conditions.

Question 10.

S 13 I 20 P 14 E 10 N 3 Score 60 Low priority

Can an improved fire-danger prediction system be devised?

This research will consider the factors which affect the inception, spread, and difficulty of control of fires and the damage they cause. It will include analysis of forest conditions, conditions on adjacent lands, and the influence of man and his activities.

Question 11.

S 14 I 17 P 14 E 5 N 5 Score 55 Low priority

In fuller detail, as a basis for more effective control than we have today, what is the behavior of forest insects and diseases?

What are the circumstances leading to damage by insects and disease? Such information will enable the forest manager to take action to prevent such conditions from developing. Particular emphasis will

be placed on defoliators and root rots. The research will be forward-looking: conducted in the context of future forest conditions and management technology.

Emphasis on old-growth conversion and on reforestation will necessarily increase the demand for effective emphasis on control of animal damage in young forests; especially damage by seed eaters, rodents, big game, and domestic stock. BLM administers its own animal-damage control program and consequently has a greater interest in research on this subject than is the case with fire, insects, and disease.

Question 12.

S 18 I 18 P 14 E 12 N 12 Score 74 Medium priority

What is the behavior of animals in young forest stands, particularly in those newly established? What animals cause what kinds of damage? How may damage best be controlled?

The key to control of animal damage lies in a better understanding of their behavior--of the biology and ecology of the pests, and particularly of the interrelationships between forest conditions and damage. Such information will enable the forest manager to avoid circumstances conducive to damage. As in the case of Question 11, research will be pursued within the context of future forest conditions and management technology.

Forest management will require increasingly intensive monitoring of forest areas for damage or conditions conducive to damage. Such monitoring will be done more and more by remote sensing techniques.

The Bureau's efforts to prevent losses and to cultivate aesthetic values will call for intensive timber-salvage programs. The Bureau's interest in such programs underscores the desirability of developing timber-harvest technology suited to the removal of individual stems without significant disturbance to others or to the ground. Timber-harvest technology is discussed on pages 43 to 46.

The need for increasingly intensive forest protection and the fact of rapidly changing forest conditions and protection technology suggest a review of all BLM protection programs.

Question 13.

S 15 I 15 P 14 E 14 N 18 Score 76 Medium priority

What improvements can be made in BLM forest-protection arrangements, methods, and intensities?

What are the current arrangements, methods, and intensities of forest protection against each of the destructive agents? How well are these procedures serving the Bureau's goals? What can be done to better the procedures in any respect? What, for example, are the pros

and cons of the contracting-out systems now in effect? The research includes bringing together the most reliable data on the extent of damage by each of the destructive agents and the forest factors related thereto, with the aim of developing reliable predictions of loss under various protection programs.

* * * *

Increasingly intensive forest management will mark the Bureau's future operations. Two circumstances conducive to intensive forest management will be (1) high demands for timber and other forest resources, (2) availability, from research, of an integrated-forestry technology and of transportation and forest-protection improvements which will make possible intensive timber production along with intensive production of other forest outputs.

Essential features of intensive timber management (besides transportation and protection) will be (a) successful tree regeneration, (b) tree improvement, (c) tree-spacing control, (d) forest-type conversion, (e) site improvement, (f) improved harvest systems, (g) effective schedules of timber-output regulation, and (h) improved methods of timber appraisal and sale.

High demand for all forest outputs and intensive management for these outputs will require prompt attention to forest regeneration. A shortening of rotations, too, will necessarily increase the emphasis on regeneration.

> *All indications for the future point to the critical importance of forest regeneration as a first feature of intensive timber management and integrated forestry.*

The criteria for judging whether land is satisfactorily regenerated have a significant impact on the BLM reforestation program and the production of all forest outputs. These criteria are an issue in themselves.

Question 14.

S 17 I 19 P 17 E 16 N 17 Score 86 Top priority

What rules should be followed in judging whether the forest is satisfactorily regenerated?

Such rules, which may well be stated in terms of an acceptable range, should consider tree numbers and characteristics, spacing, and probability of undamaged survival and satisfactory growth for the different forest uses on the different quality classes of site. Stands will be monitored and evaluated periodically over an indefinite period

and not just during the first few years of life. Remote sensing will be used increasingly for such monitoring.

Today's substantial acreage of unregenerated or lightly stocked forests, the large acreage in line for retreatment, and high treatment costs per acre all point to the need for developing improved regeneration technology, including the technology of harvesting and site preparation.

It is estimated, by current criteria, that some 55,000 acres of BLM's forest land in western Oregon (about 2 percent of the total) are unsatisfactorily regenerated. Of this area, some 18,000 acres are classified as not susceptible of regeneration by today's methods. Clear identification of the impact of delayed or inadequate regeneration on production of all forest products and services will lead the Bureau to give more attention to reforestation and to take a greater interest in developing new artificial-regeneration technology.

Question 15.

S 19 I 19 P 14 E 14 N 10 Score 76 Medium priority

What regeneration methods are available, and what sort of site preparation is required by each, on the various land-and-cover situations?

What techniques for site preparation and forest regeneration are established or newly developed? (Particular attention should be given to containerized planting and other methods which promise to be less labor-intensive and to extend the planting season.) What has been the experience with these techniques, or what promise do they show? To what situations will they be applicable on Bureau forest lands? What, then, is the Bureau's best program, so far as we know currently, for each of its classes of land and forest cover and for each of its management objectives?

Another major influence upon BLM reforestation programs will be future changes in methods of timber harvesting and slash disposal.

The prospect of logging from above with minimal site disturbance suggests two research questions relating to reforestation.

Question 16.

S 16 I 14 P 16 E 14 N 19 Score 79 High priority

What is the behavior of lands from which most or all of the forest cover is removed without disturbance to the forest floor?

What happens to the organic layer in a rain? What role may be played by down logs and trees in relation to water and erosion?

What happens to brush which has developed under decadent timber stands that are "breaking up"? How soon does vegetation appear naturally where the forest floor is left undisturbed and fire is kept out, and what are the characteristics of the vegetation? This research is closely related to Questions 32, 33, and 34, which concern future timber-harvest technology.

Question 17.

S 14 I 10 P 17 E 7 N 20 Score 68 Low priority

What are the opportunities for developing new or modified site preparation-regeneration techniques especially suited to "undisturbed" organic sites? How do these techniques compare in value one with another and with those now in use?

This research will follow up Question 16 and develop and evaluate site preparation-regeneration techniques on areas which have been logged with minimal disturbance. The research will be along the same lines as that on Question 16, but will relate specifically to those conditions created by logging from above which bear upon the re-establishment of the forest.

* * * *

A second feature of intensive timber management in an integrated-forestry program will be tree improvement.

Tree-improvement programs hold good promise for the future, notably the long future. Some pertinent characteristics of the long future are (1) dominance of fiber products and (2) preponderance of artificial regeneration.

Rapid-growing, early-developing trees will be desirable for production of fiber products.

Western Oregon is moving toward a fiber economy. The prime determinant in this movement is rising labor value. Society is all the while less willing to pay the increasing costs of labor-intensive methods of producing and installing lumber and other sawn products.

Since World War II, six of nine pulpmills constructed in the Douglas-fir region have been placed in western Oregon. During the same period, the quantity of wood used for pulping in western Oregon has increased more than six fold. During 1964-68 alone, pulp production in western Oregon nearly doubled.

Production of pulp in western Oregon will continue to expand, as it has in western Washington. Currently, the percentage of wood consumption (in cubic feet) going into fiber products in western Washington is three times that in western Oregon. The pulp industry will soon solve the pollution and transportation problems which have temporarily slowed the southward expansion of the industry in western Oregon. The industry will continue to follow the lumber industry, as has been the case in other regions.

Particleboard production in western Oregon increased more than five fold between 1961 and 1968. The development of particleboard products will be accelerated by improvements in adhesives and preforming techniques.

The fiber markets for western Oregon will be primarily the West Coast, secondarily the Lake States, Middle West, and Pacific nations. The U. S. East Coast will not be a significant part of the market.

> *The coming pre-eminence of artificial regeneration, also, will be founded, in part, upon appropriate tree-improvement measures. Trees that have rapid early root development will be especially well adapted to forthcoming changes in reforestation technology.*

Efforts in tree improvement will therefore be directed toward producing strains of trees well adapted to labor-saving methods of reforestation such as containerized planting and aerial seeding (hazards currently associated with seed protection will soon be solved). Rapid early root development is essential for success of these methods on all but the most favorable sites.

Species to be grown will be those best adapted to the sites and objectives at hand: Douglas-fir, hemlock, fir, spruce, pine, alder, and other existing species--or new species or hybrids.

Successful development of tree-improvement programs will demand research in two areas.

Question 18.

S 12 I 16 P 14 E 10 N 6 Score 58 Low priority

How can the wants of the future be met through the artificial development of new strains of trees, the breeding of new strains, and the selection of wild stock?

This research aims at artificial development of new tree strains, the selection of wild stock, and inter- and intra-specific crossings. To develop new strains artificially may involve efforts to produce mutations with the help of radiation, chemicals, and other agents. The aim will be to optimize tree characteristics per acre, not necessarily per tree. For example, the Bureau will seek to develop thrifty strains capable of yielding large quantities of fiber per acre and of producing aesthetically desirable results as a forest. That is to say, it will want to avoid strains in which the individual trees are fast-growing but, because of intolerance or because of crown or root characteristics, cooperate poorly in wood production. And it will want to avoid strains which are merely efficient fiber producers, and which are deficient in their contribution to nontimber values of the forest. In general, the Bureau will seek trees of the future, well adapted to future wants--and to such silvicultural practices as can further improve tree performance.

Research techniques that reduce the time for development of successive tree generations and shorten the progeny-testing process will accelerate tree-improvement programs. Some promising approaches are to stimulate early seed production and to forecast physical and chemical characteristics of trees at an early age, as by chemical analysis of young seedlings or seeds.

Question 19.

S 12 I 18 P 16 E 14 N 14 Score 74 Medium priority

How may BLM best develop and use on-the-ground tree-improvement techniques such as seed orchards and modernized nursery procedures?

What are the Bureau's seed requirements by tree class based upon tree characteristics, by tree-seed zone, and by class of regeneration chance? What are the alternative means for meeting the Bureau's requirements, and how do the alternatives compare? Are there opportunities for BLM to cooperate with other landowners and agencies in such research? There are, of course, the owners whose lands are intermingled with BLM lands. But beyond this, the Bureau, whose low-elevation forests are heavy and frequent seed producers, may well expand its cooperation with the Forest Service and possibly others whose holdings lie at higher elevations.

* * * *

A third feature of intensive timber management, and notably of intensive integrated forestry, is the control of tree spacing, or stand density. Spacing occupies a key position in timber production from planting through the end of the thinning regime and perhaps through the harvest cut. Spacing is also critical to the output of nontimber values.

Spacing control will be practiced whenever feasible and efficient. In the long future, spacing will be controlled in regeneration and precommercial thinning, but not to any significant extent by means of commercial thinning.

Question 20.

S 15 I 18 P 15 E 15 N 16 Score 79 High priority

What is the most desirable trend in spacing (tree numbers) over the life of a stand?

Answers to this question, given in terms of a range, will be dependent on tree species, forest site quality, risk of tree damage or loss, prospective silvicultural treatments, and the aims of management. The criteria for best spacing are a critical matter. The

research should employ various physical and financial criteria among which the user can choose. Nontimber values will, of course, be accounted for. The research relates significantly to Questions 21-25 as well as to Question 14, concerning criteria for satisfactory regeneration.

A part of spacing control is the thinning of very young stands in which tree numbers are above the norm as a result of heavy natural or artificial seeding. The appropriateness of precommercial thinning in Douglas-fir is underscored by the genetic uniformity of the species.

Under an intensive program, the forest manager may not be able to justify maintaining for long a stand whose density greatly exceeds the optimum.

Question 21.

S 13 I 15 P 12 E 13 N 16 Score 69 Medium priority

What are the promising alternative techniques for precommercial thinning?

What are the comparative merits of the various existing and prospective precommercial-thinning techniques? Most particularly, in view of high labor values, which of the techniques are the least labor-intensive and thus especially attractive? What are likely to be the

impacts of each alternative upon wildlife, aesthetic values, water, and other nontimber resources?

Question 22.

S 11 I 18 P 16 E 17 N 13 Score 75 Medium priority

Given the budget for precommercial thinning, which areas should be designated for treatment by which techniques?

Approximately what are the priorities among stands eligible for precommercial thinning, with due recognition of such constraints as upon funds, manpower, equipment, and environmental impact? The research would draw heavily on the answers to the two preceding questions.

Question 23.

S 10 I 12 P 13 E 12 N 17 Score 64 Low priority

What are the alternatives to precommercial thinning and how do they compare in value?

Questions 21 and 22 deal specifically with precommercial-thinning techniques. Question 23 calls for development and evaluation of methods alternative to precommercial thinning as a means for controlling tree spacing in young stands. Some possible alternatives are fertilization and modifications in timber-harvest, slash-disposal, and site-preparation technology.

The Bureau's interest in commercial thinning will dwindle as the years pass, following an immediate future when its interest will hold and even increase.

In the longer future, the premium upon large, clear stems will shrink. BLM will put emphasis on total wood output, not its stem-wise distribution. Labor values will be rising, and thus labor-intensive operations will be less feasible than today, while mechanized operations will hold larger advantages. Rotations will be shorter.

Consequently, BLM should attach no priority to thinning-practice research with a long payout and should concentrate on thinning questions such as the following, which promise ready answers:

Question 24.

S 10 I 19 P 15 E 16 N 13 Score 73 Medium priority

What are today's most promising opportunities for commercial thinning?

On what classes of land does commercial thinning hold greatest promise today? On what qualities of site? In forest stands of what age, density, current growth rate, tree species? Combined with what subsequent treatments, in stands possessing what nontimber values, does commercial thinning hold special promise? Since a quick payout is desired, the research will take thinning regimes as given and use

a simulation method (rather than permanent plots) to test them and judge their outcomes. Nonfinancial as well as financial criteria will be developed for weighing alternatives.

* * * *

A fourth feature of intensive timber management--type or stand, conversion--will hold less interest for BLM than the other features here considered.

Markets will continue to discriminate less and less among tree species. Increasing use of hardwoods in the pulp and paper industry will help to erase the traditional disadvantage of these species. Shorter rotations will reduce the advantage of Douglas-fir over shorter-lived trees such as red alder. Developments in regeneration technology will give the forest manager more and more control over species composition. Some variation in forest types will be desirable for aesthetic reasons and to reduce protection problems associated with an extensive monoculture. (Note: In playing down type conversion, we are not deemphasizing the need for adapting tree species and strain to the site.)

Question 25.

S 6 I 10 P 10 E 15 N 16 Score 57 Low priority

Under what circumstances will forest-type conversion prove to be desirable?

The research will consider the methods and timing of stand removal and the means for obtaining and maintaining a desirable stocking of new trees on the area.

* * * *

Interest in forest-site improvement (a fifth essential feature of intensive management) will increase significantly in the years ahead. Fundamental to a site-improvement program are reliable methods for quantifying site quality and predicting timber yield.

Before one can speak in quantitative terms of site improvement or make decisions about the sites where improvement will be undertaken, he must first have a satisfactory index of site quality. In recent years, increasing dissatisfaction has been expressed with the indexes currently available, notably tree height in relation to age. This index is unsuited to nonstocked or newly restocking areas

and is subject to doubt on various grounds, such as the influence of stand density upon the height growth of trees. Thus doubt is cast, in turn, upon our yield tables, especially in their application to managed young-growth forests.

Question 26.

S 20 I 20 P 10 E 15 N 14 Score 79 High priority

What is a reliable index of forest-site quality for timber production, and what growth and yield of timber may be anticipated on each site-quality class?

Among all the procedures of intensive forestry, site improvement in some respects holds the greatest promise and thus can claim prime attention in a research program. The improvement measures in question are forest fertilization, irrigation, and perhaps others. Such measures will be favored by the rising demands and values for timber which are in prospect. They can be a part, too, of the Bureau's efforts to produce a larger flow of nontimber outputs from the forest for consumers' benefit. Furthermore, site-improvement measures are in tune with the coming necessity to improve the efficiency of land management by concentrating efforts more and more on the acres where the rewards, in terms of public benefit, will be greatest. Research is needed to discover (a) how to introduce more mechanization into site-improvement technology, (b) how to reduce site-improvement costs, and

(c) how to effect improvement and at the same time maintain or improve environmental quality.

Question 27.

S 17 I 18 P 15 E 13 N 13 Score 76 Medium priority

What measures of forest-site improvement are worthy of consideration?

Which fertilizers and fertilization regimes hold promise for forest use? What measures of forest irrigation are worth studying? What other site-improvement measures are promising? What are the costs and, in general, the effects of the different measures--upon timber output; upon other forest values, especially the production of quality water; and upon the incidence of damage by insects, disease, animals, and forest?

Question 28.

S 15 I 15 P 13 E 15 N 18 Score 76 Medium priority

What are the comparative values of the alternative site-improvement measures?

How well do the alternative measures meet the Bureau's goals in respect to efficiency in the production of timber and nontimber benefits? To what forest situations is each measure well suited? What

are the priorities of the Bureau's different classes of forest lands for receiving site-improvement treatments?

* * * *

> *A sixth essential feature of intensive management is the improvement of timber-harvest systems. Such improvement involves better methods of harvest-regeneration silviculture, of selecting tracts for harvest-regeneration, and of logging the tracts: methods adapted to the forestry of the future, chosen with knowledge of how timber harvesting affects the forest and its values and of how the harvest is related to other forest-management programs.*

Final harvest cutting represents a critical point in forest management because it has large effects upon timber yield, nontimber outputs, and forest regeneration. The key question about the harvest is where to make it. The principles for answering this question are generally not well understood.

Question 29.

S 19 I 19 P 17 E 12 N 17 Total 84 Top priority

What are the physical outcomes of the various harvest-regeneration methods under different forest conditions?

This is the basic question, which must be answered before satisfactory answers can be had to the other questions about harvest-regeneration procedures. Some of the physical outcomes are quantity, type, and condition of regeneration and impact on aesthetic values, logging systems and costs, transportation systems, and the output of all forest products and services.

A case-study approach may be helpful in the initial stages of this work.

The question is of particular significance on dry sites in southwest Oregon, where forest regeneration is hard to obtain, and in areas where aesthetic considerations are critical.

Question 30.

S 19 I 16 P 15 E 12 N 18 Score 80 High priority

Which harvest-regeneration method is to be preferred for a given tract?

This research evaluates, in terms of BLM goals, the alternatives defined in the study of Question 29. It may well be carried out on the same case-study tracts as are used for Question 29. Its aim is to produce general decision guidelines. For this purpose, a systems approach such as described in connection with Question 40 will be helpful.

Question 31.

S 15 I 19 P 15 E 14 N 17 Score 80 High priority

Given the allowable cut, which stands are best designated for harvest?

Some of the alternatives to be evaluated are the Harvest of old vs. younger stands, accessible vs. less accessible stands, decadent vs. nondecadent stands, stands with varying risk of loss or damage by destructive agencies, one forest type vs. another, stands bearing varying relations to nontimber values, and stands of various locations, acreages, and boundary shapes. Ideally, the evaluation of alternatives will also consider the sequence of stands to be cut.

Pressures are mounting for modifications in logging technology.

Rising stumpage prices, the increasing value of labor, the necessity to reduce operating costs, and public concern over environmental damage associated with present timber-harvesting technology and associated road building--all point to a need for improvements in logging, for which today's technology is essentially old fashioned.

There is a critical need for timber-cutting and handling systems adapted to a young-growth forest economy, which

will keep the timber industry competitive by making efficient use of labor and which will fit well into a program of integrated forestry.

The southern pine region of the U. S. has significant advantages over western Oregon in respect to timber-cutting and handling costs. New technology can reduce or eliminate this advantage. Developments in timber cutting and handling will be closely tied to those in transportation (Questions 4-8).

Research in logging is critical to the future of timber management in western Oregon. Such research is appropriately done by equipment companies and large firms in the wood-using industry, as well as the Forest Service. BLM's role is, where possible, to encourage the research. The Bureau can give valuable guidance by attempting to envisage the requirements for future logging operations. The Bureau can also assist in operational testing of new equipment, perhaps in conjunction with research on Question 1.

Question 32.

S 19 I 19 P 18 E 7 N 17 Score 80 High priority

What timber-cutting and handling techniques are adapted to BLM forestry of the future?

A promising line of experimentation is with methods which lift and remove the whole tree, including branches and foliage, from the site without allowing it to touch the ground. Such methods can be expected to employ a cutting technology other than sawing and a transportation technology other than roads and wheel-propelled vehicles.

The new technology will be aimed at ameliorating many of the problems of environmental pollution, such as slash disposal, site disturbance, and extensive roadbuilding. Timber utilization will be improved because the whole tree will be brought to a processing site. The new technology will be adapted to logging near streams, campgrounds, reservoirs, and other areas requiring special treatment. It will be flexible enough for use in partial-cutting and mortality-salvage operations as well as in clearcutting. Such technology will create new regeneration problems. These are considered in Questions 16 and 17.

Question 33.

S 19 I 6 P 17 E 13 N 16 Score 71 Medium priority

What are the physical effects of the new timber-cutting and handling techniques on the various categories of forest tracts?

The consequences of new technology will be measured in terms of all aspects of the BLM forestry system and its outputs. It will be essential to test new technology on pilot tracts, such as those outlined in Question 1.

Question 34.

S 19 I 5 P 12 E 10 N 19 Score 65 Low priority

Which of the new tim ber-cutting and handling techniques is preferable under each of the major forest conditions?

What are the public reactions to the new techniques? How may public judgments be improved? How well do the new logging techniques serve BLM goals? Particularly, how well do they serve the goal of integrated forestry (Questions 1-3)? The aim of the research will be to provide general guidelines subject to modification for on-the-ground conditions. The research will follow up promising answers to Question 33.

* * * *

Effective regulation of timber output during the period of transition from an old-growth to a young-growth economy is a seventh essential feature of intensive forestry.

Assuming that sustained yield will be the guiding young-growth regulatory principle, there is still a wide range of alternatives--all compatible with the sustained-yield objective--for effecting the transition from old to young growth.

Question 35.

S 20 I 20 P 10 E 15 N 18 Score 83 Top priority

Should BLM aim to offer the same quantity of timber year after year during the old-growth period, or will some deliberate fluctuation over time be more desirable in terms of the Bureau's goals?

One sort of fluctation is the long cycle in which old-growth cutting is accelerated at the outset, though not sufficiently to produce a deep downswing below the base evenflow level later on. An approach to the research is to use an input-output (inter-industry) model of western Oregon which will reveal the impact of alternative regulatory programs on the economy. An examination of the history of cummunities which developed under a program of accelerated liquidation, perhaps in western Washington, may be helpful here. Estimates of the possible timber output of other forest owners if BLM were to follow alternative regulatory programs will help to clarify the impact of alternative BLM regulatory systems on total timber output.

Another sort of fluctuation is a relatively short cycle such as would result if the Bureau adapted its yearly offerings to current demands. The analysis will put considerable emphasis upon the role of BLM in price stabilization. The joint effect if BLM and the Forest Service were to act cooperatively should be analyzed.

* * * *

The structure of the timber market determines in great measure the return to public timber resources. Market structure also has a large influence on the wellbeing of the wood-using industry and dependent communities. Improved methods of timber marketing--i.e., appraisal and sale--are intensive management's eighth (and, for this report, last) essential feature.

The issue of how receipts from timber sales are distributed, important as it is, is not viewed as part of BLM forestry and consequently is omitted from consideration here.

The necessity for difficult and time-consuming stumpage appraisals stems primarily from the fact that the market does not determine values reliably.

Question 36.

S 17 I 19 P 14 E 15 N 18 Score 83 Top priority

What are the characteristics of the markets in which BLM timber is sold? What are the characteristics of markets which produce acceptable valuations of timber? How may BLM assure itself of the services of markets which set values reliably?

What constitutes an acceptable set of standards for BLM timber-market performance? How may such standards be attained? If acceptable market performance can be achieved and a satisfactory degree of competition ensured, may it not be possible to simplify timber-appraisal procedures, put less reliance on appraisal, or, in some cases, eliminate appraisal entirely?

In any case, today's stumpage-appraisal system is in urgent need of an overhaul.

The Bureau's system for stumpage appraisal is so all-inclusive and complex that it is difficult to comprehend. Thus its use may lead to misunderstandings and ill will between buyer and seller. Furthermore, the system is increasingly expensive to maintain, update, and apply.

Question 37.

S 18 I 20 P 10 E 12 N 16 Score 76 High priority

What are the promising alternatives to the present stumpage-appraisal system--either modifications of the present system or totally different approaches?

The research aims at revision of the appraisal system. It is closely tied to studies of Question 36. Perhaps a dual effort can be made: to play down appraisal and to simplify it.

The shift to young-growth management will require changes in timber-sales procedures, which are currently oriented to old-growth timber.

Changes in timber-harvesting technology, the characteristics of the timber harvested, and the circumstances surrounding the harvest, such as public sensitivity to environmental impacts, call for altering, not only the appraisal system (Question 37), but also timber-sales procedures, including sale location and layout, timber marking, timber-volume estimation, contract preparation, method of auction, and contract administration.

Question 38.

S 19 I 16 P 16 E 13 N 16 Total 80 High priority

What are the promising alternatives to current timber-sales procedures--either modifications of current procedures or totally different approaches?

What are the prospects for developing more efficient techniques for timber-sale location, layout, volume estimation, and contract administration? What of increased use of remote-sensing techniques? What about landscape simulators to help identify the visual impact of proposed timber sales? What of the employment of electronic or photographic techniques for timber volume measurement in the woods or at the point of utilization?

One aspect of timber-sales procedure which deserves special mention is the choice of product to be sold. Sales of cut timber may be preferable to sales of standing timber in their effect upon timber returns, utilization, and appraisal problems.

Although federal forestry agencies have traditionally sold their timber output in the form of stumpage, such practice is not necessarily the most satisfactory, and some analysis of it is justified. An alternative worth investigating is the sale of logs rather than standing timber. In some of the European countries where forestry is farthest advanced, the sale of logs from public forests is the accepted practice. Within the Douglas-fir region, large-scale private forest owners sell a substantial part of their timber output as logs. Such practice on public forests may well increase returns to the public, both by setting favorable price levels and by encouraging close utilization of wood raw material. At the same time, it may greatly lighten the appraisal burden.

Question 39.

S 14 I 15 P 16 E 13 N 19 Score 77 Medium priority

What are the pros and cons of the sale of cut products rather than stumpage by BLM?

How do cut-products sales compare with stumpage sales in respect to the Bureau's control over logging and over the forest management system as a whole? --in respect to the Bureau's net returns, which are a function of gross returns and costs of sale, including appraisal? --in respect to influences upon the wood-conversion industries and their dependent communities? Under what circumstances does each of the two methods promise to hold the advantage?

* * * *

Looking at intensive forestry as a whole, with all its essential features, one sees that these are interdependent and that therefore BLM had best include in its research a systems view of forestry improvement.

All the foregoing silvicultural, engineering, and sales questions are interrelated. For example, the best thinning regime depends in part on the site-improvement program; the best site-improvement program depends in part on the tree-improvement program; this, in turn, is partly a function of marketing programs; and so on. Consequently, there is weakness inherent in the separate evaluation of individual practices or procedures. Conceptually, at least, all practices and procedures require joint evaluation. Furthermore, such

alternatives as transportation systems and forest-protection measures should be brought into consideration at the same time. Nontimber values must, of course, be held in view. And the scheduling of the management measures and developments must be planned simultaneously.

Question 40.

S 18 I 20 P 12 E 15 N 19 Score 84 Top priority

What is the most desirable silvicultural-protection-transportation-logging-sales program for a BLM master unit?

The criterion for desirability is the degree of approximation to BLM goals, including those for nontimber outputs. Such criteria as benefit-cost ratio, rate of return on investment, and present net worth are largely insignificant. A promising approach to the research is the use of a simulation model of master-unit resources and activities.

* * * *

To emphasize the systems view of Bureau operations is to underscore the value of research which will interpret BLM as a whole, both to the general public and within

the organization: BLM's role in the economy, its operating record, its data systems, and its needs for research. These lines of inquiry are the final subject of this problem analysis.

Large segments of the general public are interested in such questions as the Bureau's contribution to regional resources of recreation, timber, water, and wildlife and the Bureau's impact on regional employment and income. BLM employees, too, are in constant need of such information, particularly in their work with local officials and special-interest groups and in their budget discussions.

Question 41.

S 18 I 20 P 19 E 5 N 15 Score 77 High priority

What is the impact of each major BLM activity upon each of the principal sectors of the western Oregon economy?

How much will it matter to each of the region's principal industries and to its households, in terms of income and employment, if the Bureau intensifies its forest regeneration program? --enlarges its road system? --changes its allowable cut? --puts more emphasis on its recreational developments? An input-output (inter-industry) study provides a suitable approach to such research. The research will be of considerable value in a study of forest regulatory alternatives (Question 35).

Of interest, also, to the general public and to BLM personnel is the record of BLM operations in western Oregon.

Question 42.

S 12 I 16 P 20 E 14 N 15 Score 77 Medium priority

What is the extent of resources managed by BLM; how are these resources managed; what are the outputs of the management; and how do these outputs affect the western Oregon economy?

More specifically: What is the inventory of BLM-managed resources in the counties and districts of western Oregon? What management measures does BLM follow, and on what scale? What improvements, such as the building of roads and recreation sites, has BLM accomplished? What resource losses have occurred, as from fire, insects, disease, and other agents? What budget allocations, allowable timber cuts, and the like have set the pace for BLM over the years? What physical quantities of output have been produced? What revenues and employment have flowed from BLM management? Where have these revenues been allocated? What are the impacts of BLM activities upon the economy at large? The research will make use of information developed in Question 41 and elsewhere. Perhaps the results can be assembled in loose-leaf form, convenient for updating.

* * * *

Beyond its need for such information as just described, the Bureau requires an automated system for acquiring, storing, and retrieving data on its resource operations--this system to be developed in accordance with a comprehensive plan. Putting the various Stock and flow items into a single, unified system holds immense advantages, particularly if integrated land management is to be practiced successfully. For example, it is helpful to organize timber, recreation, wildlife-habitat, fisheries-habitat, and other land-resource data into a single system which will make available both tabulated statistics and maps as needed. These kinds of data, in turn, can well be brought together with other management-oriented information such as that concerning budget, receipts, personnel, equipment, and the like. Provision should be made for a computerized system which lends itself readily to the internal and external updating of information and to the retrieval of historical records for specific tracts and larger areas at the request of the user. The system may well include provisions for testing the reliability of existing data and determining additional information needed for maintaining and improving reliability.

Question 43.

S 15 I 16 P 17 E 12 N 17 Score 77 High priority

How can BLM best automate its resource-data acquisition, storage, updating, and retrieval?

The necessary research is best carried out by a team representing the disciplines concerned, including management and including also, but not dominated by, ADP sciences.

* * * *

Finally, among the Bureau's high-priority research needs is the need for continuing problem analysis designed to attune the research program to the demands of progressive resource management in a rapidly changing world. BLM's immense long-range responsibilities require such attention to problem analysis.

Question 44.

S 17 I 14 P 16 E 16 N 10 Score 73 High priority

What are the current and prospective forest management research problems of BLM, and how may the appraisal of these problems be revised in step with the changing circumstances surrounding BLM forestry?

Such effort should be carried out continually on an informal basis by both researchers and management, and formalized periodically. It will be helpful to consult with knowledgeable persons outside BLM in making the analysis.

APPENDIX

RESEARCH QUESTIONS BY PRIORITY CLASS

Question		Page
	Top Priority	
1	Pilot program for integrated forestry	12
14	Rating the success of forest regeneration	25
29	Forest impacts of alternative harvest-regeneration methods	41
35	Alternative systems of timber regulation	47
36	Characteristics of BLM timber markets	48
40	Systems view of BLM forestry	53
	High Priority	
2	Integrated forestry technology	13
3	Guides to integrated-forestry decisions	14
4	Adapting management to changes in transportation technology	16
16	Behavior of areas logged without disturbance	27
20	Desired trends in tree spacing	33
26	Timber site quality, growth, and yield	39
30	Guides to decisions on harvest-regeneration methods	42
31	Stand priorities for timber harvesting	43
32	New timber-cutting and handling technology	44
37	Alternative stumpage-appraisal systems	49
38	Alternative timber-sales procedures	50
41	BLM's impact on the economy	54
43	A data system for BLM	56
44	Continuing appraisal of forestry problems	57

Question		Page
	Medium Priority	
6	Guides to road design	18
7	Roading priorities	18
12	Animal damage in young stands	22
13	Improving forest protection	23
15	Reforestation technology	26
19	Developing a tree-improvement program	32
21	Precommercial-thinning technology	34
22	The precommercial-thinning program	35
24	Choice of stands for commercial thinning	36
27	Alternative site-improvement methods	40
28	Guides to site-improvement decisions	40
33	Effects of new logging methods on BLM forestry	45
39	Cut-products vs. stumpage sales	51
42	A description of BLM resources and management	55
	Low Priority	
5	An ideal road system	17
8	Scheduling road abandonment	18
9	Constructive methods of dealing with logging slash	20
10	Improving fire-danger prediction	21
11	Behavior of forest insects and diseases	21
17	Reforestation of areas logged without disturbance	28
18	Tree-improvement technology	31
23	Alternatives to precommercial thinning	35
25	Guides to forest-type conversion	38
34	Choosing among the new logging methods	46

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225

'S CARD

1971

and

BLM forestry

	OFFICE	DATE RETURNED

(Continued on reverse)

SD 144 .07 D994 1971
Dwyer, John F.
Research needs and
priorities for BLM forestry

BLM LIBRARY
RS 150A BLDG. 50
DENVER FEDERAL CENTER
P.O. BOX 25047
DENVER, CO 80225